Laboratory of Cardiovascular Science - Research Program

Experimental Model	Intrinsic Mechanisms	Acute Modulation of Intrinsic Mechanisms	Chronic Modulation of Intrinsic Mechanisms
Humans	Cardiac structure Vascular structure Cardiovascular function at rest	Drugs Postural reflexes Exercise stress	Age, gender, race, socioeconomic status Disease (CAD, hypertension), risk factors, and prevention Genetics
Intact Animals **Heart Failure** **Hypertension** **Aging** **Preconditioning** **Arterial Injury**	Arterial remodeling of aging Cardiac remodeling post myocardial infarction, endogenous na/K ATPase ligands Gene expression VSMC proliferation and migration	Novel drugs	Age Growth factors Diet Thyroid status Local or systemic drug delivery Gene therapy Stem cell therapy
Isolated Heart or Cardiac Muscle	Myocardial contractile properties, excitation-contraction coupling, Ca2+ signals, action potentials	Ischemia Anoxia, hypoxia Free radicals Neuropeptides Novel drugs Stretch	Age Diet Exercise Hyperthyroid state Cardiomyopathy Heart failure
Cardiac Cells **Myocytes** **Fibroblasts**	Membrane ionic channel currents Cardiac cell contraction Cystolic Ca2+ signals Mitochondrial Ca2+ signals Sarcolemmal ion transport Sarcoplasmic Reticulum function Apoptosis	Receptor stimulated second messengers Neuropeptides Stretch Anoxia, hypoxia Free radicals Novel drugs Anesthetics Growth factors Novel endocardial factors Novel endothelial factors	Development Age Disease Heart failure Hypertension Diet Growth factors Hypoxia
Vascular Smooth Muscle and Endothelial Cells	Cystolic Ca2+ and pH regulation Proliferation and secretion Chemotaxis and invasion Matrix regulation Tubulin/microtuble dynamics Differentation regulation Angiogenesis	Shear stress Receptor agonists/antagonists Growth factors Anoxia, hypoxia Stretch Anti-microtubule agents Matrix degradation Antisense inhibition and gene overexpression	Atherosclerosis Arterial injury Aging Dedifferentation
Stem Cells	Mechanisms of pluripotency	Homing factors	Differentation into heart and vascular cells
Sub-Cell Organelles	Na/K transport systems Sarcolemmal ion channels Sarcoplasmic reticulum Ca2+ cycling Mitochondrial membrane potential regulation, ATP K+ channels	Ionic composition Adenine nucleotides Neuropeptides Ischemia, anoxia Drugs Reactive oxygen species	Age Heart failure Hypertension
Molecules	Genomics-SAGE cDNA assays Control mechanism of gene expression in heart and vascular cells, ryanodine receptors, IP 3 receptors, G proteins Expression of (1) isozymes: e.g. myosin heavy chain, Na-K ATPase, (2) proteins HSP oncogenes, ANF, pump or channels proteins (e.g. SR Ca ATPase, sarcolemmal Ca 2+ and K+ channels	Ionic transportation mechanisms Stretch mechanisms Growth factors Neuropeptides Nitric Oxide Reactive oxygen species	Age Hormones Hypertension Heart failure Genetic manipulation